2024-2027

PhD Thesis at LMGP and MEM

Advanced Microscopy and optimisation of Ga_2O_3 layers

Summary: We are looking for a motivated and curious PhD student that likes materials science and eager to help optimising the growth of Ga_2O_3 layers by using advanced Transmission Electron Microscopy (TEM) techniques, in particular high resolution, electron diffraction, energy dispersive X-ray (EDX) spectroscopy and ptychography. The student will work in deep collaborations with the teams growing the Ga_2O_3 layers, the teams characterizing electrically these layers and of course the teams using and developing the electron microscopy techniques.

By joining our teams, you will have the unique opportunity to explore the convergence of Ga_2O_3 potential with cutting-edge TEM techniques, driving transformative breakthroughs in power electronics and materials science.

Context: On one hand, there is a growing demand for high-performance, low-power consumption power electronic devices, and the monoclinic β-phase of gallium oxide (Ga_2O_3) emerges as a highly promising contender for such applications. β-Ga_2O_3 offers an array of advantages, including an ultra-wide band gap (~4.9 eV), a high breakdown electric field (approximately 8 MV/cm), an appropriate intrinsic electron mobility limit (μ = 250 $cm^2/(V \cdot s)$), and cost-effectiveness. As a result, β-Ga_2O_3 has the potential to outperform SiC and GaN for high-voltage and/or high-power applications.

On the other hand, considerable progress is being made in the field of transmission electron microscopy. In particular, the possibility of discerning the three-dimensional atomic structure of nanostructures using advanced TEM techniques such as ptychography has already been demonstrated. These advancements hold immense promises as by enabling a better understanding of the elaborated structures they should help to optimise materials and devices, in particular the one involving Ga_2O_3 layers, the topic of this PhD subject.

Scientific environment: The PhD will take place in MINATEC, Grenoble, France. MINATEC is one of Europe's leading innovation campuses dedicated to micro-nanotechnologies and their applications. It brings together academic research, industry, and technology transfer activities in a collaborative environment to foster innovation and drive economic growth. Two laboratories of MINATEC, LMGP and MEM, will supervise and help the PhD work. β-Ga_2O_3 (undoped or Zn-doped) and $(Al,Ga)_2O_3$ alloys will be deposited chemically at the LMGP laboratory by PLI-MOCVD or ALD. TEM studies will be performed either at LGMP or at the MINATEC Nanocharacterisation platform (PFNC) as MEM is part of it. So, the Phd student will have access the PFNC extensive equipment, in particular the brand new JEOL NEOARM or TITAN corrected microscopes.

MINATEC Web site: https://www.minatec.org/en/
MEM Web site: https://www.mem-lab.fr/en/Pages/Presentation.aspx
LMGP Web Site: http://www.lmgp.grenoble-inp.fr/

Required background: The applicant should have an Engineering degree and/or a Master of Science in materials physics and chemistry, nanosciences, and/or semiconductor physics. Specific skills regarding team work, English abilities, and working with computers will be required for her/his integration into the team and for taking part in the ongoing international collaborations.

Fundings: LABEX MateriAlps. PhD thesis duration: 36 months from Fall 2024

Contacts :
Please, send your CV, motivation letter, and transcripts by e-mail to:

Dr. Eirini SARIGIANNIDOU eirini.sarigiannidou@grenoble-inp.fr Tel : 04 56 52 93 33

Dr. Jean-Luc ROUVIERE jean-luc.rouviere@cea.fr Tel : 04 38 78 50 86